CLAIMS

1. A method of driving an electromagnetic pump that conveys a fluid from a pump chamber formed inside a cylinder by housing a plunger including a permanent magnet inside the cylinder and passing a current through an aircore electromagnetic coil fitted around the cylinder to reciprocally move the plunger in the axial direction inside the cylinder,

wherein a pulse voltage is applied alternately on a positive side and a negative side to drive the electromagnetic coil such that a change in voltage that occurs when the polarity of the pulse voltage is inverted has a continuous slope at least between the positive side and the negative side.

2. A method of driving an electromagnetic pump according to Claim 1, wherein a sinewave-shaped pulse voltage is applied to drive the electromagnetic coil.

3. A method of driving an electromagnetic pump according to Claim 1, wherein a driving voltage V(t) is applied in a range provided by Equation (1) below where a maximum value of the driving voltage V(t) applied to the electromagnetic coil is set at Vmax

$$0.8 \cdot Vmax \cdot \sin(\omega t) < V(t) < 1.5 \cdot Vmax \cdot \sin(\omega t) \quad \text{... Equation (1)}$$

(where t: time and ω: angular velocity).

4. A method of driving an electromagnetic pump that conveys a fluid from a pump chamber formed inside a cylinder by housing a plunger including a permanent magnet inside the cylinder and passing a current through an aircore electromagnetic coil fitted around the cylinder to reciprocally move the plunger in the axial direction inside the cylinder,

wherein the current flowing through the electromagnetic coil is detected

and a pulse current flows where a change in current that occurs when the polarity of the current is inverted has a continuous slope at least between the positive side and the negative side.

5. A method of driving an electromagnetic pump according to Claim 4, wherein the current is controlled so that a sinewave-shaped pulse current flows in the electromagnetic coil.

6. A method of driving an electromagnetic pump according to Claim 4, wherein a driving current I(t) is controlled in a range provided by Equation (2) below where a maximum value of the driving current I(t) that flows in the electromagnetic coil is set at Imax

$$0.8 \cdot Imax \cdot \sin(\omega t) < I(t) < 1.5 \cdot Imax \cdot \sin(\omega t) \quad \ldots \text{ Equation (2)}$$

(where t: time and ω: angular velocity).

7. A method of driving an electromagnetic pump that conveys a fluid from a pump chamber formed inside a cylinder by housing a plunger including a permanent magnet inside the cylinder and passing a current through an aircore electromagnetic coil fitted around the cylinder to reciprocally move the plunger in the axial direction inside the cylinder,

wherein a pulse voltage is applied or a pulse current flows including a period where a voltage or current value is zero when the polarity of a driving voltage or a supplied current of the electromagnetic coil is inverted.

8. A method of driving an electromagnetic pump according to Claim 7, wherein the pulse voltage is applied or the pulse current flows so that
before the period where the voltage or current value is zero, a minute voltage pulse of at least 30% of a maximum voltage is applied or a minute current pulse of at least 30% of a maximum current flows.

9. A method of driving an electromagnetic pump that conveys a fluid from a pump chamber formed inside a cylinder by housing a plunger including a permanent magnet inside the cylinder and passing a current through an aircore electromagnetic coil fitted around the cylinder to reciprocally move the plunger in the axial direction inside the cylinder,

wherein a pulse voltage is applied or a pulse current flows so that an offset voltage of no greater than 30% of a maximum voltage is applied or an offset current of no greater than 30% of a maximum current flows when the polarity of a driving voltage or a supplied current of the electromagnetic coil is inverted.

10. A method of driving an electromagnetic pump according to Claim 9, wherein the pulse voltage is applied or the pulse current flows so that before a period where the offset voltage is applied or the offset current flows, a minute voltage pulse of at least 30% of the maximum voltage is applied or a minute current pulse of at least 30% of the maximum current flows.